Alternative 4—Construct New Research Reactor. The proposed new research reactor would provide ample neutrons for the production of plutonium-238 and for many of the representative isotopes. The thermal flux would limit the new research reactor's ability to produce a number of isotopes requiring fast or high-energy neutrons. Its lower flux levels (10^{13} neutrons per square centimeter per second) and predominantly thermal flux would limit its ability to support many of the projected nuclear-based research and development needs.

S.7 CUMULATIVE IMPACTS

The projected environmental impacts of (1) constructing (as necessary) and operating the proposed facilities to store, fabricate, irradiate, and process the various targets addressed in the NI PEIS for 35 years and (2) deactivating FFTF were added to the environmental impacts of other present and reasonably foreseeable future actions at or near the identified sites to obtain cumulative site impacts under normal conditions. The other present and reasonably foreseeable future actions at or near the candidate sites are included in the baseline impacts presented in Chapter 3 of the NI PEIS. Cumulative transportation impacts were determined by analyzing the impacts along the various routes used to transport the materials associated with nuclear infrastructure activities over the 35-year period.

In this section, cumulative site impacts are presented only for those "resources" at a site that may reasonably be expected to be affected by the storage, fabrication, irradiation, and processing of the various targets. These include site employment, electrical consumption, water usage, air quality, waste management, and public and occupational health and safety. This section also includes the cumulative impacts associated with intersite transportation.

Impacts of the following are considered in the cumulative site impact assessment:

- Current (baseline) activities at or in the vicinity of the candidate sites
- Other onsite and offsite activities that are reasonably foreseeable and documented
- Construction (as necessary), operation, and deactivation (as necessary) of the proposed nuclear infrastructure facilities to fabricate, irradiate, and process targets

Details of activities that may be implemented in the foreseeable future at any of the nuclear infrastructure candidate sites and evaluated in the cumulative impact assessment are given in the following documents:

- *Surplus Plutonium Disposition Final Environmental Impact Statement* (DOE 1999a) (Record of Decision issued)

- *Storage and Disposition of Weapons-Usable Fissile Materials Final Programmatic Environmental Impact Statement* (DOE 1996a) (Record of Decision issued)

- *Disposition of Surplus Highly Enriched Uranium Final Environmental Impact Statement* (DOE 1996b) (Record of Decision issued)

- *Final Programmatic Environmental Impact Statement for Tritium Supply and Recycling* (DOE 1995b) (Record of Decision issued)

- *Final Waste Management Programmatic Environmental Impact Statement for Managing Treatment, Storage, and Disposal of Radioactive and Hazardous Waste* (DOE 1997a) (Records of Decision issued for the various waste types)

- *Department of Energy Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Final Environmental Impact Statement* (DOE 1995c) (Record of Decision issued)

- *Final Environmental Impact Statement on a Proposed Nuclear Weapons Nonproliferation Policy Concerning Foreign Research Reactor Spent Nuclear Fuel* (DOE 1996c) (Record of Decision issued)

- *Final Programmatic Environmental Impact Statement for Stockpile Stewardship and Management* (DOE 1996d) (Record of Decision issued)

- *Advanced Mixed Waste Treatment Project Final Environmental Impact Statement* (DOE 1999b) (Record of Decision issued)

- *Final Environmental Impact Statement for Management of Spent Nuclear Fuel from the K-Basins at the Hanford Site, Richland, Washington,* (DOE 1996e) (Record of Decision issued)

- *Final Environmental Impact Statement for the Tank Waste Remediation System, Hanford Site, Richland, Washington* (DOE 1996f) (Record of Decision issued)

- *Hanford Reach of the Columbia River Comprehensive River Conservation Study and Environmental Impact Statement*, *Final* (NPS 1994) (Record of Decision issued)

- *Final Hanford Comprehensive Land-Use Plan Environmental Impact Statement* (DOE 1999c) (Record of Decision issued)

- *Final Environmental Impact Statement for the Treatment and Management of Sodium-Bonded Spent Nuclear Fuel* (DOE 2000b) (Record of Decision issued)

- *Final Environmental Impact Statement, Construction and Operation of the Spallation Neutron Source* (DOE 1999d) (Record of Decision issued)

- *Final Programmatic Environmental Impact Statement for Alternative Strategies for the Long-Term Management and Use of Depleted Uranium Hexafluoride* (DOE 1999e) (Record of Decision issued)

- *Idaho High-Level Waste and Facilities Disposition Draft Environmental Impact Statement* (DOE 1999f)

- *Final Environmental Impact Statement for Treating Transuranic (TRU)/Alpha Low-Level Waste at the Oak Ridge National Laboratory, Oak Ridge, Tennessee* (DOE 2000c) (Record of Decision issued)

- *Environmental Assessment Melton Valley Storage Tanks Capacity Increase Project - Oak Ridge National Laboratory, Oak Ridge, Tennessee* (DOE 1995d) (FONSI issued)

- *Environmental Assessment for Management of Spent Nuclear Fuel on the Oak Ridge Reservation, Oak Ridge, Tennessee* (DOE 1996g) (FONSI issued)

- *Environmental Assessment - Management of Hanford Site Non-Defense Production Reactor Spent Nuclear Fuel, Hanford Site, Richland, Washington* (DOE 1997b) (FONSI issued)

- *Environmental Assessment for Transportation of Low-Level Radioactive Waste from the Oak Ridge Reservation to Off-Site Treatment or Disposal Facilities* (DOE 2000d)

- *Environmental Assessment for Transportation of Low-Level Radioactive Mixed Waste from the Oak Ridge Reservation to Off-Site Treatment or Disposal Facilities* (DOE 2000e) (Draft issued)

- *Environmental Assessment for Selection and Operation of the Proposed Field Research Centers for the Natural and Accelerated Bioremediation Research (NABIR) Program* (DOE 2000f) (FONSI issued)

The related programs included in the cumulative impact assessment for the potentially affected candidate sites are identified in **Table S–11**.

Table S–11 Other Present and Reasonably Foreseeable Actions Considered in the Cumulative Impact Assessment

Activities	ORR	INEEL	Hanford
Disposition of Surplus Plutonium	X		
Storage and Disposition of Weapons-Usable Fissile Materials	X	X	X
Disposition of Surplus Highly Enriched Uranium	X		
Waste Management PEIS	X	X	X
Spent Nuclear Fuel Management and INEL Environmental Restoration and Waste Management		X	X
Foreign Research Reactor Spent Nuclear Fuel Management		X	X
Stockpile Stewardship and Management	X		
Tank Waste Remediation			X
Radioactive Releases from WNP Nuclear Power Plant			X
Hanford Reach of the Columbia River Comprehensive River Conservation Study			X
Hanford Comprehensive Land Use Plan			X
K Basins Spent Fuel Management			X
Advanced Mixed Waste Treatment Project		X	
Treatment and Management of Sodium-Bonded Spent Nuclear Fuel		X	
Construction and Operation of the Spallation Neutron Source	X		
Long-Term Management and Use of Depleted Uranium Hexafluoride	X		
Treatment and Shipment of Transuranic Waste	X		
Management of Liquid Low-Level Radioactive Waste	X		
Management of Spent Nuclear Fuel	X		
Transportation of Low-Level Radioactive Waste to Off-Site Treatment or Disposal	X		
Transportation of Low-Level Radioactive Mixed Waste to Off-Site Treatment or Disposal	X		
Natural and Accelerated Bioremediation Field Research Center Assessment	X		
Idaho High-Level Waste and Facilities Disposition		X	

Source: Table 4–162 of the NI PEIS.

In the tables that are included in the following sections, all relevant activities at each site are identified to the extent possible. They include existing and reasonably foreseeable activities, and those associated with nuclear infrastructure operations. The impacts associated with the latter are specifically shown as "New Nuclear Infrastructure Operations." They include the impacts from construction (as necessary), operation, and deactivation (as necessary) of the proposed target fabrication, irradiation, and processing facilities assessed in the NI PEIS.

A bounding option was analyzed for each site. The bounding option is the option that would involve the greatest amounts of operational activities and associated environmental impacts at the candidate site. For example, the bounding option for ORR is Option 7 of Alternative 2, under which both HFIR and REDC operations would be involved in plutonium-238 production.

In addition to reasonably foreseeable site activities, other activities within the regions of the candidate sites were considered in the cumulative impact analysis for the selected resources. However, because of the distances between the candidate sites and these other existing and planned facilities, there is little opportunity for interactions among them.

Cumulative Impacts at ORR

For ORR, the bounding option for the NI PEIS is Option 7 of Alternative 2. This option calls for the operation of HFIR to irradiate neptunium-237 targets and operation of REDC to fabricate and process these targets and other neptunium-237 targets irradiated in ATR. The impacts associated with HFIR and REDC operations for other missions are included under "existing site activities."

Resource Requirements. Cumulative impacts on resource requirements at ORR are presented in **Table S–12**. ORR would remain within its site capacity for all major resources. If Option 7 of Alternative 2 were implemented, the proposed nuclear infrastructure facilities would require essentially no change in the site's use of electricity or water. Cumulatively, ORR would use approximately 10 percent of its electrical capacity and 37 percent of its water capacity. Site employment would increase by approximately 41 workers.

Table S–12 Maximum Cumulative Resource Use and Impacts at ORR

Activities	Site Employment	Electrical Consumption (megawatt-hours per year)	Water Usage (million liters per year)
Existing site activities[a]	14,215	726,000	14,210
Storage and Disposition PEIS	Included above	7,260	0.24
Waste Management PEIS	1,259	84,160	394
Spallation Neutron Source	744	543,120	1,592
Treatment and Shipment of Transuranic Waste	17	3,000	3.8
New nuclear infrastructure operations[b]	41[c]	Negligible[d]	2.86
Total	16,276	~1,363,540	16,203
Total site capacity	NA	13,880,000	44,348

a. Reflects current sitewide activities that are anticipated to continue during all or part of the 35-year period evaluated for proposed nuclear infrastructure operations.
b. Nuclear infrastructure activities from Alternative 2, Option 7.
c. Some, or all, of these worker requirements may be filled by the reassignment of the existing site workforce.
d. Additional electricity consumption associated with this option would be negligible compared to that associated with existing facility activities.

Note: To convert from liters per year to gallons per year, multiply by 0.264; to convert from megawatt-hours to British thermal units, multiply by 3.42×10^6; ~ means "approximately" and indicates that new nuclear infrastructure operations would contribute only minimally.
Key: NA, not applicable.
Source: Table 4–163 of the NI PEIS.

Air Quality. Cumulative impacts on air quality at ORR are presented in **Table S–13**. ORR is currently in compliance with all Federal and state ambient air quality standards, and would continue to be in compliance even if the cumulative effects of all activities are included. As shown in the table, the contributions of nuclear infrastructure operations to overall site concentrations would be very small.

Table S–13 Maximum Cumulative Air Pollutant Concentrations at ORR for Comparison with Ambient Air Quality Standards

Parameter	Carbon Monoxide		Nitrogen Dioxide	PM_{10}		Sulfur Dioxide		
Averaging Period	8 hours	1 hour	Annual	Annual	24 hours	Annual	24 hours	3 hours
Activities								
Existing site activities[a] (micrograms per cubic meter)	7.75	26.5	0.98	1.6	12.6	4.76	33.4	106.4
HEU disposition[b] (micrograms per cubic meter)	11.5	53	1.33	0.03	0.37	2.46	29.3	161
Waste management program (micrograms per cubic meter)	0	0	0	3	9	2.4	11	39
Spallation Neutron Source (micrograms per cubic meter)	69	99	16	1.9	23	0.1	1	2.4
New nuclear infrastructure operations[c] (micrograms per cubic meter)	0	0	1.99×10^{-4}	0	0	0.04	0.31	0.7
Total concentration (micrograms per cubic meter)	88.3	179	18.3	6.53	45	9.76	75	310
Standard								
Most stringent standard[d] (micrograms per cubic meter)	10,000	40,000	100	50	150	80	365	1,300

a. Environmental impacts associated with existing site activities (based on 1998 emissions from the *Oak Ridge Reservation Annual Site Environmental Report 1998*) that are anticipated to continue during part or all of the 35-year period evaluated for nuclear infrastructure operations. The values in this row reflect a curtailment of stockpile stewardship management activities during this time period.
b. Highly enriched uranium disposition activities.
c. Nuclear infrastructure activities from Alternative 2, Option 7.
d. The more stringent of the Federal and state standards is presented if both exist for the averaging period.
Source: Table 4–164 of the NI PEIS.

Public and Occupational Health and Safety—Normal Operations. Cumulative impacts in terms of radiation exposure to the public and workers at ORR are presented in **Table S–14**. There would be no increase expected in the number of latent cancer fatalities in the population from ORR site operations if nuclear infrastructure operations were to occur at HFIR and REDC. The dose limits for individual members of the public are given in DOE Order 5400.5. As discussed in that Order, the dose limit from airborne emissions is 10 millirem per year, as required by the Clean Air Act; the dose limit from drinking water is 4 millirem per year, as required by the Safe Drinking Water Act; and the dose limit from all pathways combined is 100 millirem per year. Therefore, as is evident in Table S–14, the dose to the maximally exposed individual would be expected to remain well within the regulatory limits. Onsite workers would be expected to see an increase of approximately 0.17 latent cancer fatality due to radiation from nuclear infrastructure operations over the 35-year operational period.

Table S–14 Maximum Cumulative Radiation Impacts at ORR

Impact	Maximally Exposed Individual		Population Dose Within 80 Kilometers (50 Miles) (Year 2020)		Total Site Workforce	
	Annual Dose (millirem per year)	Risk of a Latent Cancer Fatality[a]	Dose (person-rem)	Number of Latent Cancer Fatalities[a]	Dose (person-rem per year)	Number of Latent Cancer Fatalities[a]
Existing site activities[b]	4.4	7.7×10^{-5}	60.3	1.1	103	1.4
HEU disposition	0.039	6.8×10^{-7}	0.16	0.0028	11	0.16
Stockpile stewardship and management	0.2	3.5×10^{-6}	0.6	0.011	-1.8	-0.025
Waste management	0.35	6.1×10^{-6}	1.2	0.021	0.45	0.0063
New nuclear infrastructure operations at ORR[c]	1.9×10^{-6}	3.3×10^{-11}	8.8×10^{-5}	1.5×10^{-6}	12	0.168
Total	5.0[d]	8.7×10^{-5}[(d)]	62	1.1	125	1.7

a. These values are calculated based on a 35-year exposure period.
b. Environmental impacts associated with present activities at ORR that are anticipated to continue during all or part of the 35-year period evaluated for proposed nuclear infrastructure operations.
c. Impacts are bounded by Option 7 of Alternative 2.
d. The same individual would not be expected to be the maximally exposed individual for all activities at ORR. The location of the maximally exposed individual depends upon where on the site an activity is performed. However, to provide an upper bound of the cumulative impacts to the maximally exposed individual, the impacts from each activity have been summed.
Source: Table 4–165 of the NI PEIS.

Waste Management. Cumulative amounts of wastes generated at ORR are presented in **Table S–15**. It is unlikely that there would be major impacts on waste management at ORR because sufficient capacity would exist to manage the site wastes. As discussed in Section 4.3.1.1.13 of the NI PEIS, irrespective of how the waste from processing irradiated neptunium-237 targets is classified (i.e., transuranic or high-level radioactive), the waste composition and characteristics are the same, and the management (i.e., treatment and onsite storage), as described in the NI PEIS, would be the same. In addition, either waste type would require disposal in a suitable repository. None of the options assessed in the NI PEIS would generate more than a small amount of additional waste at ORR.

Cumulative Impacts at INEEL

For INEEL, the bounding option for the NI PEIS is Option 2 of Alternative 2. This option calls for the operation of ATR to irradiate neptunium-237 targets and operation of FDPF to fabricate and process these targets. The impacts associated with ATR and FDPF operations for other missions are included under "existing site activities."

Resource Requirements. Cumulative impacts on resource requirements at INEEL are presented in **Table S–16**. INEEL would remain within its site capacity for all major resources. If Option 2 of Alternative 2 were implemented, the proposed nuclear infrastructure facilities would require essentially no change in the site's use of electricity or water. Cumulatively, INEEL would use 80 percent of its electrical capacity and 13 percent of its water capacity. Site employment would increase by approximately 24 workers.

Table S–15 Cumulative Impacts on Waste Management Activities at ORR Over the 35-Year Period (cubic meters)

Waste Type	Existing Site Activities	Treatment and Shipment of Transuranic Waste[a]	Surplus Plutonium Disposition[b]	Spallation Neutron Source[c]	New Nuclear Infra-structure Operations[d]	Total	Site Capacity[e] Treatment (cubic meters/ year)	Site Capacity[e] Storage	Site Capacity[e] Disposal
Transuranic (High-level radio-active)[f]	766 (0)	607 (0)	11 (0)	0 (0)	385 (385)	1,769 (385)	4,050/ 5 years (0)	2,845 (0)	NA (NA)
Low-level radioactive	335,755	2,778	140	612,000	<2,145	~952,818	440,405	87,776	NA
Mixed low-level radioactive	28,035	23	1	623	<175	~28,857	263,560	234,226	NA
Hazardous[g] (kilograms)	1,260,000	0	1	1,435,000	227,500	2,922,501	1,738,803	7,312	NA
Nonhazardous									
Liquid	23,845,500	1,560	1,500	2,415	99,925	23,950,900	3,395,918	NA	NA
Solid	2,590,000	5,500	130	47,215	5,180	2,648,025	NA	NA	1,219,000

a. Data from the *Final Environmental Impact Statement for Treating Transuranic (TRU)/Alpha Low-Level Waste at the Oak Ridge National Laboratory* Low-Temperature Drying Alternative was selected in the Record of Decision (65 FR 48683).
b. Data from the *Surplus Plutonium Disposition Final EIS* (DOE 1999a:4-394) postirradiation examination (2006 through 2009) and selected in Record of Decision (65 FR 1608).
c. Data from the *Spallation Neutron Source Final EIS*.
d. Option 7 of Alternative 2. This alternative would generate the most waste for all waste types.
e. Total 35-year and annual capacity derived from Table 3–13 of the NI PEIS.
f. Volumes in parentheses represent high-level radioactive waste. Section 4.3.1.1.13 of the NI PEIS provides a discussion on classification of waste from processing irradiated neptunium-237 targets.
g. Assumes for hazardous waste that 353 kilograms equal 1 cubic meter (22.0 pounds equal 1 cubic foot).

Note: To convert from cubic meters to cubic yards, multiply by1.308; < means "less than"; ~ means "approximately;" NA, not applicable (i.e., the majority of the waste is not routinely treated, stored, or disposed of on site).
Source: Table 4–166 of the NI PEIS.

Table S–16 Maximum Cumulative Resource Use and Impacts at INEEL

Activities	Site Employment	Electrical Consumption (megawatt-hours per year)	Water Usage (million liters per year)
Existing site activities[a]	7,993	232,500	4,830
SNF Management and INEL Environmental Restoration and Waste Management	–	2,200	2
Foreign Research Reactor SNF Management	–	1,000	2
Waste Management PEIS	–	13,980	194
Advanced Mixed Waste Treatment Project	–	33,000	16
High-Level Waste and Facilities Disposition	–	33,000	351
New nuclear infrastructure operations[b]	24[c]	Negligible[d]	1.68
Total	8,017	~315,680	5,397
Total site capacity	NA	394,200	43,000

a. Reflects current sitewide activities (except that "Site Employment" value also reflects projected employment from other activities) that are anticipated to continue during all or part of the 35-year period evaluated for proposed nuclear infrastructure operations.
b. Nuclear infrastructure activities from Alternative 2, Option 2.
c. Some, or all, of those worker requirements may be filled by the reassignment of the existing workforce.
d. Additional electricity consumption associated with this option would be negligible compared to that associated with existing facility activities.

Note: To convert from liters per year to gallons per year, multiply by 0.264; to convert from megawatt-hours to British thermal units, multiply by 3.42×10^6; ~ means "approximately," and indicates that new nuclear infrastructure operations would contribute only minimally.
Key: NA, not applicable; SNF, spent nuclear fuel.
Source: Table 4–167 of the NI PEIS.

Air Quality. Cumulative impacts on air quality at INEEL are presented in **Table S–17**. INEEL is currently in compliance with all Federal and state ambient air quality standards, and would continue to remain in compliance, even with consideration of the cumulative effects of all activities. The contributions of nuclear infrastructure operations to overall site concentrations are expected to be very small.

Table S–17 Maximum Cumulative Air Pollutant Concentrations at INEEL for Comparison with Ambient Air Quality Standards

Parameter	Carbon Monoxide		Nitrogen Dioxide	PM_{10}		Sulfur Dioxide		
Averaging Period	8 hours	1 hour	Annual	Annual	24 hours	Annual	24 hours	3 hours
Activities								
Existing site activities[a] (micrograms per cubic meter)	78	206	0.46	0.49	12	0.14	5.3	24
ANL–W contribution[b] (micrograms per cubic meter)	41	59	13	0.14	1.1	3.3	27	60
Advanced Mixed Waste Treatment Project[c] (micrograms per cubic meter)	0.85	115	0.34	0.006	4.6	0.012	4.5	25
HLW & facilities disposition[d] (micrograms per cubic meter)	4.2	10	0.19	0.02	0.28	0.57	8.9	42
New nuclear infrastructure operations[e] (micrograms per cubic meter)	0	0	3.66×10^{-4}	0	0	0.024	0.19	0.43
Total concentration (micrograms per cubic meter)	124	390	14	0.656	18	4.05	45.9	151
Standard								
Most stringent standard[f] (micrograms per cubic meter)	10,000	40,000	100	50	150	80	365	1,300

a. Environmental impacts associated with existing site activities (excluding activities at ANL–W) as shown in the *Idaho High-Level Waste and Facilities Disposition Draft EIS*, and in the *Final EIS for the Treatment and Management of Sodium-Bonded Spent Nuclear Fuel*. The activities whose concentrations are given in this row are anticipated to continue during part or all of the 35-year period evaluated for proposed nuclear infrastructure operations.
b. The contribution from existing ANL–W sources as shown the *Final EIS for the Treatment and Management of Sodium-Bonded Spent Nuclear Fuel*.
c. *Advanced Mixed Waste Treatment Project EIS* activities—proposed action with microencapsulation or vitrification.
d. High-level waste and facilities disposition site boundary contribution for planning basis option.
e. Nuclear infrastructure activities from Alternative 2, Option 2.
f. The more stringent of the Federal and state standards is presented if both exist for the averaging period.

Key: ANL–W, Argonne National Laboratory–West; HLW, high-level radioactive waste.
Source: Table 4–168 of the NI PEIS.

Public and Occupational Health and Safety—Normal Operations. Cumulative impacts in terms of radiation exposure to the public and workers at INEEL are presented in **Table S–18**. There would be no increase expected in the number of latent cancer fatalities in the population from INEEL site operations if nuclear infrastructure operations were to occur at ATR and FDPF. The dose limits for individual members of the public are given in DOE Order 5400.5. As discussed in that Order, the dose limit from airborne emissions is 10 millirem per year, as required by the Clean Air Act; the dose limit from drinking water is 4 millirem per year, as required by the Safe Drinking Water Act; and the dose limit from all pathways combined is 100 millirem per year. Therefore, as is evident in Table S–18, the dose to the maximally exposed individual would be expected to remain well within the regulatory limits. Onsite workers would be expected to see an increase of approximately 0.17 latent cancer fatality due to radiation from nuclear infrastructure operations over the 35-year operational period.

Table S–18 Maximum Cumulative Radiation Impacts at INEEL

Impact	Maximally Exposed Individual: Annual Dose (millirem per year)	Maximally Exposed Individual: Risk of a Latent Cancer Fatality[a]	Population Dose Within 80 Kilometers (50 Miles) (Year 2020): Dose (person-rem)	Population Dose Within 80 Kilometers (50 Miles) (Year 2020): Number of Latent Cancer Fatalities[a]	Total Site Workforce: Dose (person-rem per year)	Total Site Workforce: Number of Latent Cancer Fatalities[a]
Existing site activities[b]	0.008	1.7×10^{-7}	0.075	0.0013	64.9	0.91
Storage and disposition	1.6×10^{-6}	2.8×10^{-11}	1.8×10^{-5}	3.2×10^{-7}	25	0.35
Foreign research reactor spent nuclear fuel	5.6×10^{-4}	9.8×10^{-9}	0.0045	7.9×10^{-5}	33	0.46
Spent nuclear fuel	0.008	1.4×10^{-7}	0.19	0.0033	5.4	0.076
Advanced Mixed Waste Treatment Project	0.022	3.9×10^{-7}	0.009	1.6×10^{-4}	4.1	0.057
High-level waste and facilities disposition	0.002	3.5×10^{-8}	0.10	0.0018	59	0.83
Sodium-bonded spent nuclear fuel	0.002	3.5×10^{-8}	0.012	2.1×10^{-4}	22	0.31
New nuclear infrastructure operations at ATR and FDPF[c]	2.6×10^{-7}	4.6×10^{-12}	3.9×10^{-6}	6.8×10^{-8}	12	0.17
Total	0.043[d]	7.4×10^{-7}(d)	0.39	0.0068	225.4	3.16

a. These values are calculated based on a 35-year exposure period.
b. Environmental impacts associated with present activities at INEEL that are anticipated to continue during all or part of the 35-year period evaluated for proposed nuclear infrastructure operations.
c. Impacts are bounded by Option 2 of Alternative 2.
d. The same individual would not be expected to be the maximally exposed individual for all activities at INEEL. The location of the maximally exposed individual depends upon where on the site an activity is performed. However, to provide an upper bound of the cumulative impacts to the maximally exposed individual, the impacts from each activity have been summed.

Source: Table 4–169 of the NI PEIS.

Waste Management. Cumulative amounts of wastes generated at INEEL are presented in **Table S–19**. It is unlikely that there would be major impacts on waste management at INEEL because sufficient capacity would exist to manage the site wastes. As discussed in Section 4.3.2.1.13, irrespective of how the waste from processing of irradiated neptunium-237 targets is classified (i.e., transuranic or high-level radioactive), the waste composition and characteristics are the same, and the management (i.e., treatment and onsite storage), as discussed in the NI PEIS, would be the same. In addition, either waste type would require disposal in a suitable repository. None of the alternatives assessed in the NI PEIS would generate more than a small amount of additional waste at INEEL.

Table S–19 Cumulative Impacts on Waste Management Activities at INEEL Over the 35-Year Period (cubic meters)

Waste Type	Existing Site Activities	Idaho HLW and Facility Disposition EIS[a]	Treatment and Management of Sodium-Bonded SNF[b]	New Nuclear Infrastructure Operations[c]	Total	Site Capacity[d]		
						Treatment (cubic meters/ year)	Storage	Disposal (cubic meters/ year)
Transuranic (High-level radioactive)[e]	65,000[f] (0)	110 (0)	14 (0)	245 (245)	65,369 (245)	57,794 (6,434)	190,319 (19,483)	NA (NA)
Low-level radioactive	135,600	15,325	862	<2,320	~154,107	42,363	177,493	69,530
Mixed low-level radioactive	3,767	12,837	40	<175	~16,819	157,092	187,761	NA
Hazardous	1,180	2,457	0	227,500 kilograms (644 cubic meters)[g]	4,281	NA	9,619	NA
Nonhazardous	124,905	145,262	4,960	64,015	339,142	3,200,000	NA	3,062,000

a. Data from the *Idaho HLW and Facility Disposition EIS*, Separations Alternative. Maximum quantities for any alternative.
b. Data from the *Treatment and Management of Sodium-Bonded Spent Nuclear Fuel EIS*, Alternative 1, electrometallurgically treat blanket and driver fuel at ANL–W; 12 years of operation and selected in the Record of Decision (65 FR 56565).
c. Option 2 of Alternative 2 would generate the most waste for all waste types.
d. Total 35-year and annual capacity derived from Table 3–27 of the NI PEIS.
e. Volumes in parentheses represent high-level radioactive waste. Section 4.3.2.1.13 of the NI PEIS provides a discussion on classification of waste from processing irradiated neptunium-237 targets.
f. This 65,000 cubic meters is in storage at the Radioactive Waste Management Complex.
g. Assumes for hazardous waste that 353 kilograms equals 1 cubic meter (22.0 pounds equals 1 cubic foot).

Note: To convert from cubic meters to cubic yards, multiply by 1.308; HLW means high-level radioactive waste; SNF means spent nuclear fuel; < means "less than"; ~ means "approximately;" NA, not applicable (i.e., the majority of the waste is not routinely treated, stored, or disposed of on site).
Source: Table 4–170 of the NI PEIS.

Cumulative Impacts at Hanford

For Hanford, the bounding option for the NI PEIS depends on the parameter assessed. For example, under Public and Occupational Health and Safety, the highest radiological doses and associated latent cancer fatalities to the public would be associated with Option 1 of Alternative 1, whereas the highest doses and latent cancer fatalities to workers would be associated with Option 3 of this same alternative. Processing of targets in RPL versus processing in FMEF accounts for there being different bounding options. For each of the parameters addressed in this section, a footnote is included in each of the cumulative impact tables, as necessary, to indicate the bounding alternative/option.

Resource Requirements. Cumulative impacts on resource requirements at Hanford are presented in **Table S–20**. Hanford would remain within its site capacity for all major resources. If any of the options under Alternative 1 were implemented, the proposed nuclear infrastructure facilities would require a small increase in the site's use of electricity and water. For the bounding options identified in Table S–20, this would reflect an increase of about 2 and 1 percent, respectively, over current baseline utilization for these resources. There would be no additional land disturbance or development. Cumulatively, Hanford would use approximately, 23 percent of its electrical capacity and 38 percent of its water capacity. Site employment would increase by approximately 130 workers.

Air Quality. Cumulative impacts on air quality at Hanford are presented in **Table S–21**. Hanford is currently in compliance with all Federal and state ambient air quality standards, and would continue to be in compliance even with consideration of the cumulative effects of all activities. The nuclear infrastructure contributions to overall site concentrations are expected to be very small.

Table S–20 Maximum Cumulative Resource Use and Impacts at Hanford

Activities	Site Employment	Electrical Consumption (megawatt-hours per year)	Water Usage (million liters per year)
Existing site activities[a]	16,005	323,128	2,754[b]
Tank waste remediation system	–	170,000	200
Waste Management PEIS	–	13,920	133
New nuclear infrastructure operations[c]	130[d]	55,000	80
Total	16,135	562,048	3,167
Total site capacity	NA	2,484,336	8,263[b]

a. Reflects current sitewide activities. The"Site Employment" value also reflects projected employment from other activities that are anticipated to continue during all or part of the 35-year period evaluated for proposed nuclear infrastructure operations.
b. Reflects domestic/potable water only and not raw water usage or availability.
c. Electrical consumption and water usage are bounded by Option 3 or 6 of Alternative 1, with the values reflecting the increase over standby operations from restart of FFTF and associated support activities in FMEF.
d. Some, or all, of these worker requirements may be filled by the reassignment of the existing site workforce.

Note: To convert from liters per year to gallons per year, multiply by 0.264; to convert from megawatt-hours to British thermal units, multiply by 3.42×10^6.
Key: NA, not applicable.
Source: Table 4–171 of the NI PEIS.

Table S–21 Maximum Cumulative Air Pollutant Concentrations at Hanford for Comparison with Ambient Air Quality Standards

Parameter	Carbon Monoxide		Nitrogen Dioxide	PM_{10}		Sulfur Dioxide			
Averaging Period	8 hours	1 hour	Annual	Annual	24 hours	Annual	24 hours	3 hours	1 hour
Activities									
Existing site activities[a] (micrograms per cubic meter)	27.3	63.3	0.666	0.0182	1.01	0.175	30.17	69.4	79.4
Tank waste remediation[b] (micrograms per cubic meter)	34	48	0.12	0.0079	0.75	0.020	1.6	3.6	4
Spent nuclear fuel management[c] (micrograms per cubic meter)	0	0	0.1	0	0	0	0	0	0
New nuclear infrastructure FFTF operations[d] (micrograms per cubic meter)	52.1	74.4	0.0118	8.39×10^{-4}	9.84	0.00785	9.11	20.5	22.8
New nuclear infrastructure FMEF operations[d] (micrograms per cubic meter)	0	0	4.43×10^{-5}	0	0	0.0087	0.069	0.16	0.17
Total concentration (micrograms per cubic meter)	113.4	185.7	0.90	0.027	11.6	0.212	40.9	93.7	106
Standard									
Most stringent standard[e] (micrograms per cubic meter)	10,000	40,000	100	50	150	50	260	1,300	660

a. Environmental impacts associated with existing activities. These activities are anticipated to continue during part or all of the 35-year period evaluated for proposed nuclear infrastructure operations.
b. *Hanford Tank Waste Remediation EIS* activities, vitrification facilities, Phased Implementation – Phase II Operation.
c. *Spent Nuclear Fuel Management* – regionalization alternative.
d. Nuclear infrastructure contributions are bounded by Alternative 1, Option 3. Periodic testing of emergency diesel generators would result in higher values for certain pollutants and time periods.
e. The more stringent of the Federal and State standards is presented if both exist for the averaging period.

Note: The contribution from activities in the *Final Waste Management Programmatic EIS* are small and are not shown.
Source: Table 4–172 of the NI PEIS.

Public and Occupational Health and Safety—Normal Operations. Cumulative impacts in terms of radiation exposure to the public and workers at Hanford are presented in **Table S–22**. There would be no increase expected in the number of latent cancer fatalities in the population from Hanford site operations if nuclear infrastructure operations were to occur at FMEF. The dose limits for individual members of the public are given in DOE Order 5400.5. As discussed in that order, the dose limit from airborne emissions is 10 millirem per year, as required by the Clean Air Act; the dose limit from drinking water is 4 millirem per year, as required by the Safe Drinking Water Act; and the dose limit from all pathways combined is 100 millirem per year. Therefore, as is evident in Table S–22, the dose to the maximally exposed individual would be expected to remain well within the regulatory limits. Onsite workers would be expected to see an increase of approximately 0.26 latent cancer fatality due to radiation from nuclear infrastructure operations over the 35-year operational period.

Table S–22 Maximum Cumulative Radiation Impacts at Hanford

	Maximally Exposed Individual		Population Dose Within 80 Kilometers (50 Miles) (Year 2020)		Total Site Workforce	
Impact	**Annual Dose (millirem per year)**	**Risk of a Latent Cancer Fatality[a]**	**Dose (person-rem)**	**Number of Latent Cancer Fatalities[a]**	**Dose (person-rem per year)**	**Number of Latent Cancer Fatalities[a]**
Existing site activities[b]	0.02	3.5×10^{-7}	0.6	0.011	181	2.5
Waste management	0.0057	2.9×10^{-9}	0.28	0.0014	1,300	5.2
Tank remediation	(c)	2.4×10^{-6}	(c)	0.19	(c)	3.27
Spent nuclear fuel management	(c)	1.4×10^{-8}	(c)	8.0×10^{-4}	(c)	0.057
Burial of low-level waste	0	0	0	0	1,018	0.41
Plutonium Finishing Plant stabilization	0.13	3.9×10^{-7}	2.3	0.007	157	0.38
New nuclear infrastructure operations at FFTF and FMEF or RPL[d]	0.0054	9.5×10^{-8}	0.25	0.0044	18	0.26
Total	(e)	3.3×10^{-6}[(f)]	(e)	0.21	(e)	12

a. These values are calculated based on a 35-year exposure period except for waste management (project duration for waste transfer of 10 years) and Plutonium Finishing Plant stabilization (a 6-year project).
b. Environmental impacts associated with present activities at Hanford (including activities at other non-DOE facilities at or near Hanford) that are anticipated to continue during all or part of the 35-year period evaluated for proposed nuclear infrastructure operations.
c. Source document provides project total; annual values are not constant.
d. Impacts on the public are bounded by Option 1 of Alternative 1; impacts on workers are bounded by Option 3 of Alternative 1.
e. Some source documents did not provide dose values, only expected latent cancer fatalities. Therefore, no total dose estimates have been developed.
f. The same individual would not be expected to be the maximally exposed individual for all activities at Hanford. The location of the maximally exposed individual depends upon where an activity is performed on the site. However, to provide an upper bound cumulative impact for the maximally exposed individual, the impacts from each activity have been summed.

Source: Table 4–173 of the NI PEIS.

Waste Management. Cumulative amounts of wastes generated at Hanford are presented in **Table S–23**. It is unlikely that there would be major impacts on waste management at Hanford because sufficient capacity would exist to manage the site wastes. As discussed in Sections 4.3.3.1.13 and 4.4.3.1.13 of the NI PEIS, irrespective of how the waste from processing of irradiated neptunium-237 targets is classified (i.e., transuranic or high-level radioactive), the waste composition and characteristics are the same, and the management (i.e., treatment and onsite storage), as described in the NI PEIS, would be the same. In addition, either waste type would require disposal in a suitable repository. None of the alternatives assessed in the NI PEIS would generate more than a relatively small amount of additional waste at Hanford.

Table S–23 Cumulative Impacts on Waste Management Activities at Hanford Over the 35-Year Period (cubic meters)

Waste Type	Existing Site Activities	New Nuclear Infrastructure Operations	Total	Site Capacity[a]		
				Treatment (cubic meters/ year)	Storage	Disposal
Transuranic (High-level radioactive)[b]	9,880 (0)	385[c] (385)	10,265 (385)	98,520 (50,000)	17,216 (146,000)	NA (NA)
Low-level radioactive	95,666	5,015[c]	100,681	398,112	99,910	1,970,000
Mixed low-level radioactive	46,207	315[c]	46,522	413,211	100,483	14,200
Hazardous	19,600	3,100[d]	22,700	NA	NA	NA
Nonhazardous						
Liquid	7,000,000	1,494,500[c]	8,494,500	120,000	NA	4,807,720
Solid	1,505,000	10,500[c]	1,515,500	NA	NA	NA

a. Total 35-year and annual capacity derived from Table 3–36 of the NI PEIS.
b. Volumes in parentheses represent high-level radioactive waste. Sections 4.3.3.1.13 and 4.4.3.1.13 of the NI PEIS provide a discussion on classification of waste from processing irradiated neptunium-237 targets.
c. The bounding alternative for this waste type is Alternative 1, Option 3 or 6.
d. The bounding alternative for this waste type is Alternative 2, Option 3, 6 or 9; Alternative 3, Option 3; or Alternative 4, Option 3; which all include the deactivation of FFTF and neptunium-237 target fabrication and processing at FMEF. The inventory of bulk metallic sodium is not included because alternative sponsors and/or users will be found for its disposition.

Note: To convert from cubic meters to cubic yards, multiply by1.308; < means "less than"; ~ means "approximately"; NA, not applicable.
Source: Table 4–174 of the NI PEIS.

Spent Nuclear Fuel Management. The operation of FFTF for the proposed mission at 100 megawatts for 35 years under Alternative 1 would produce a total of about 16 metric tons of heavy metal (35,200 pounds) of spent nuclear fuel. The existing spent nuclear fuel at Hanford is about 2,133 metric tons of heavy metal (4,700,000 pounds) (DOE 1995c). The management of the existing spent nuclear fuel at Hanford results in a dose of less than 0.1 millirem per year to the maximally exposed member of the public. This dose is well within the DOE dose limits cited in DOE Order 5400.5. DOE has committed to remove the spent nuclear fuel at Hanford for ultimate disposition in a geologic repository. The restart of FFTF under Alternative 1 would generate 16 metric tons of heavy metal of spent nuclear fuel, which is less than 1 weight-percent of the total spent nuclear fuel inventory presently at Hanford. Only a small fraction of the dose shown for nuclear infrastructure operations would be attributable to the management of this spent nuclear fuel at FFTF. The doses at Hanford, including those associated with spent nuclear fuel management, would remain within the DOE dose limits.

Cumulative Impacts at the Generic CLWR Site

No incremental environmental impacts at the generic site would be expected with the normal operation of a CLWR to irradiate targets. Therefore, the cumulative impacts at the generic CLWR site would not be affected by any action assessed in the NI PEIS, and are not addressed further.

Cumulative Impacts at the New Accelerator(s) Generic DOE Site

Cumulative impacts cannot be presented for a generic site. If Alternative 3 were selected for implementation, a subsequent site-specific analysis would be conducted for the DOE site chosen for the combination of new accelerator(s) and support facility or research reactor only, and appropriate NEPA documentation would be prepared to address the cumulative impacts for that site.

Cumulative Impacts at the New Research Reactor Generic DOE Site

Cumulative impacts cannot be presented for a generic site. If Alternative 4 were selected for implementation, a subsequent site-specific analysis would be conducted for the DOE site chosen for the new research reactor and support facility or research reactor only, and appropriate NEPA documentation would be prepared to address the cumulative impacts for that site.

Cumulative Impacts of Transportation

Because likely transportation routes cross many states, cumulative impacts are compared on a national basis. Under all alternatives assessed in the NI PEIS, occupational radiation exposure to transportation workers and exposure to the public are estimated to each represent less than 0.05 percent of the cumulative exposures from nationwide transportation over the 35-year period of nuclear infrastructure activities. No additional traffic fatality is expected; the increase in traffic fatalities would be less than 0.0001 percent per year.

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